PROPOSAL

V2V COLLISION AVOIDANCE

2022 / 2023

Prepared For :

GraduationProject

Al-Azhar University

Faculty of Engineering

Electronics and Communication Department

CONTENT

- ABOUT OUR TEAM P.3
- V2V INTRODUCTION P.4
- PROJECT OBJECTIVES P.4
- PROJECT DESCRIPTION P.5
- PROJECT ANALYSIS P.6
- PROJECT SYSTEMS P.8
- SOFTWARE ARCHITECTURE P.19
- REFERENCES P.20

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V2V INTRODUCTION

Vehicle-to-vehicle (V2V) communication's ability to wirelessly exchange information about the speed and position of surrounding vehicles shows great promise in helping to avoid crashes, ease traffic congestion, and improve the environment. But the greatest benefits can only be achieved when all vehicles can communicate with each other.

Using vehicle-to-vehicle (V2V) communication, a vehicle can detect the position and movement of other vehicles up to a quarter of a kilometer away. In a real world where vehicles are equipped with a simple antenna, a computer chip and GPS (Global Positioning System) Technology, your car will know where the other vehicles are, additionally other vehicles will Know where you are too whether it is in blind spots, stopped ahead on the highway but hidden from view, around a blind corner or blocked by other vehicles. The vehicles can anticipate and react to changing driving situations and then instantly warn the drivers with emergency warning messages. If the driver doesn't respond to the alerts message, the vehicle can bring itself to a safe stop, avoiding a collision.

PROJECT OBJECTIVES

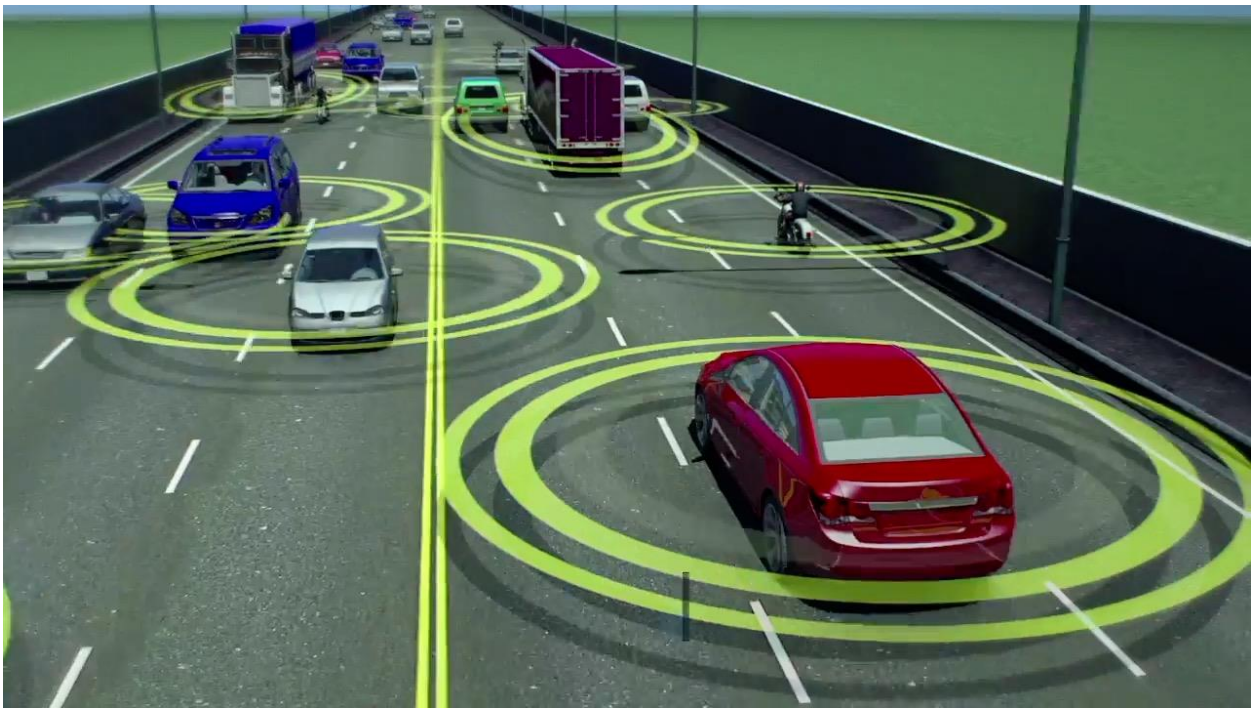
We wanted our project to fulfill the user's needs and expectations, thus we had some vision of these needs
and planned its scope and our approach to satisfy it.

- Regulation of cars motion so that no car can not detect the other cars motion information in its
prespecified range .
- Guaranteeing safety to people on the road.

PROJECT DESCRIPTION

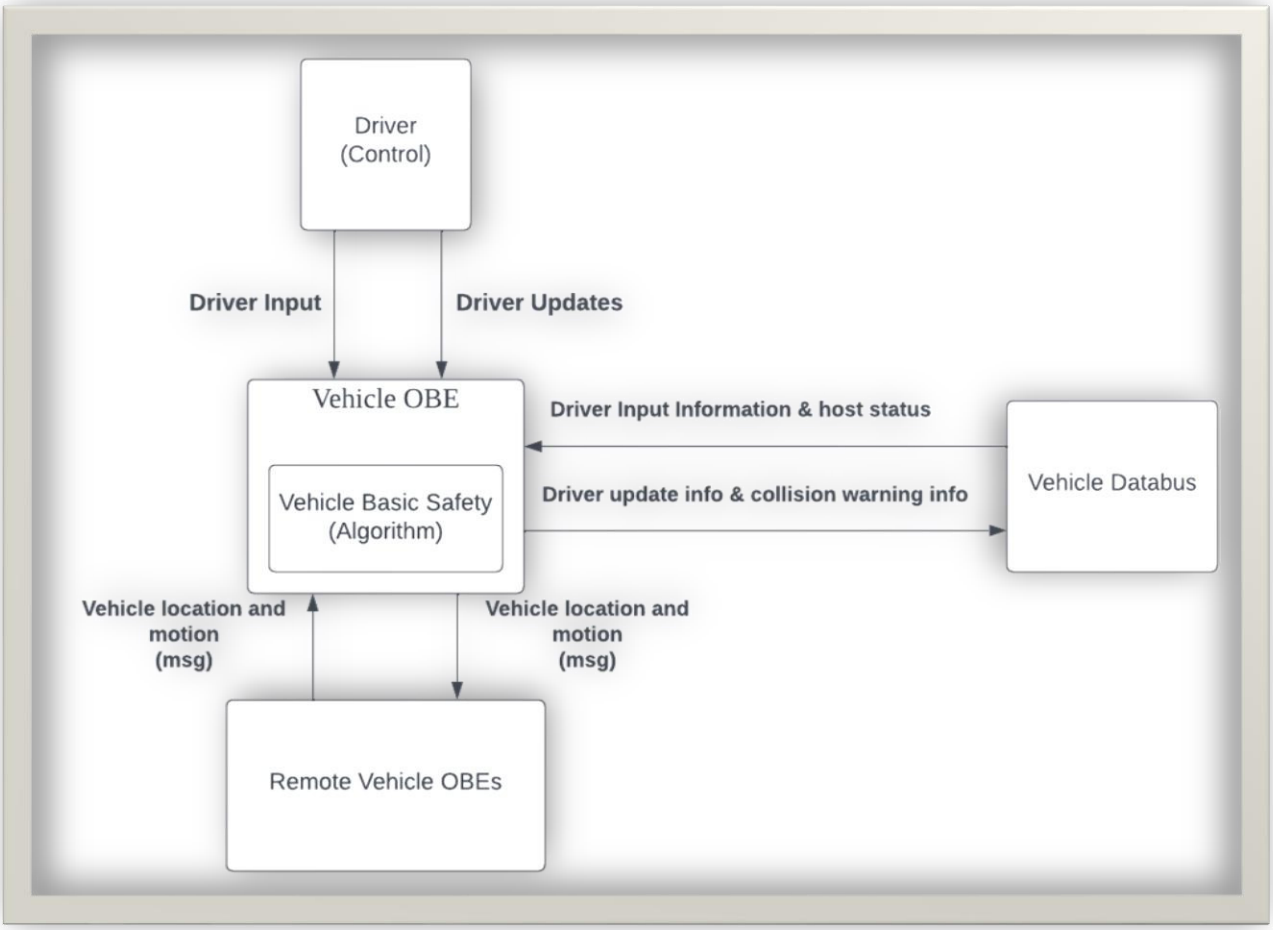
Using vehicle-to-vehicle (V2V) communication, a vehicle can detect the position and movement of other
vehicles up to a quarter of a kilometer away. In area world where vehicles are equipped with a simple
antenna, a computer chip and GPS (Global Positioning System) Technology, your car will know where
the other vehicles are, additionally other vehicles will Know where you are too whether it is in blind
spots, stopped ahead on the highway but hidden from view, around a blind corner or blocked by other
vehicles. The vehicles can anticipate and react to changing driving situations and then instantly warn the
drivers with emergency warning messages.

If the driver doesn't respond to the alerts message, the vehicle
can bring itself to a safe stop, avoiding a collision.
So, our project elaborates Implementation of a real time vehicle to vehicle communication system over a
local WIFI network between cars where we broadcast car data and state to avoid potential collisions.

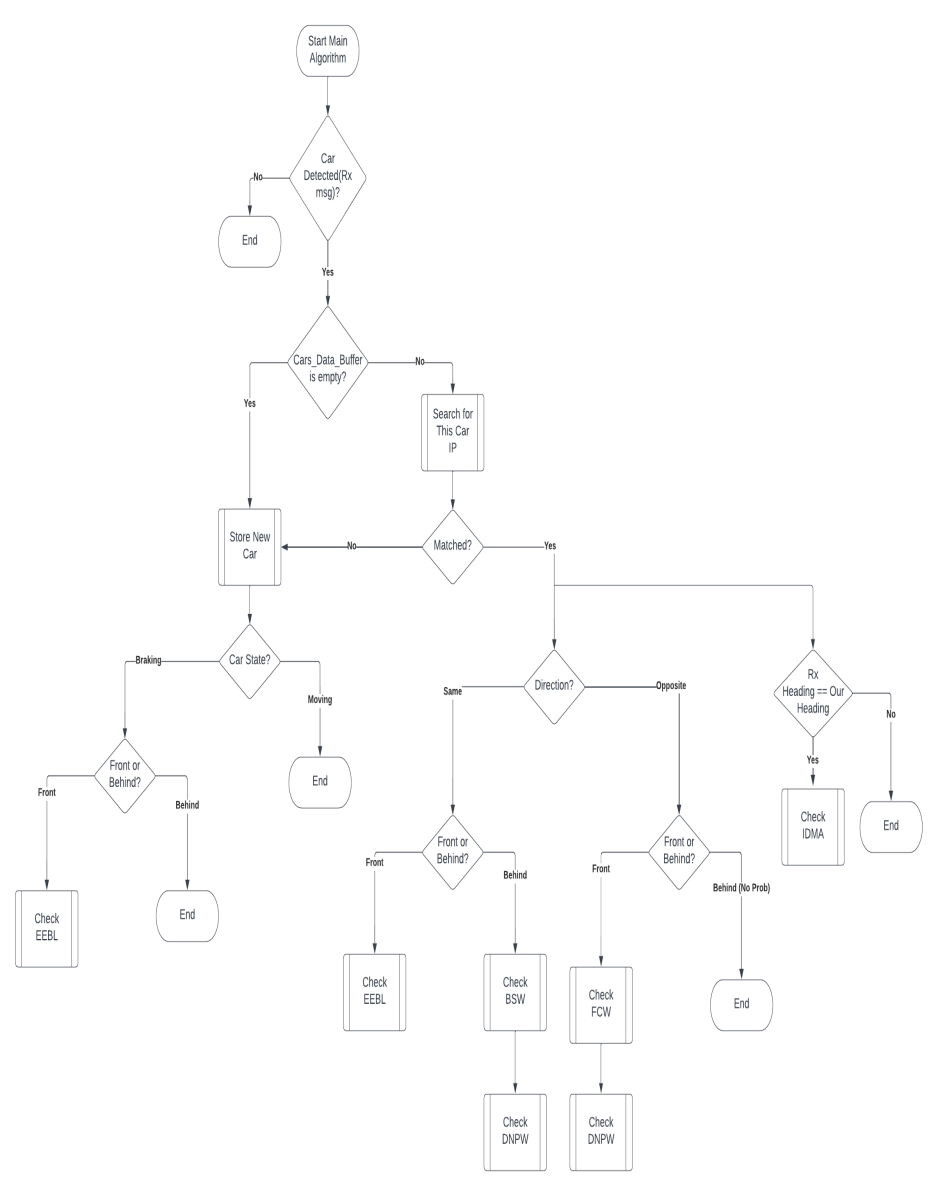


PROJECT ANALYSIS

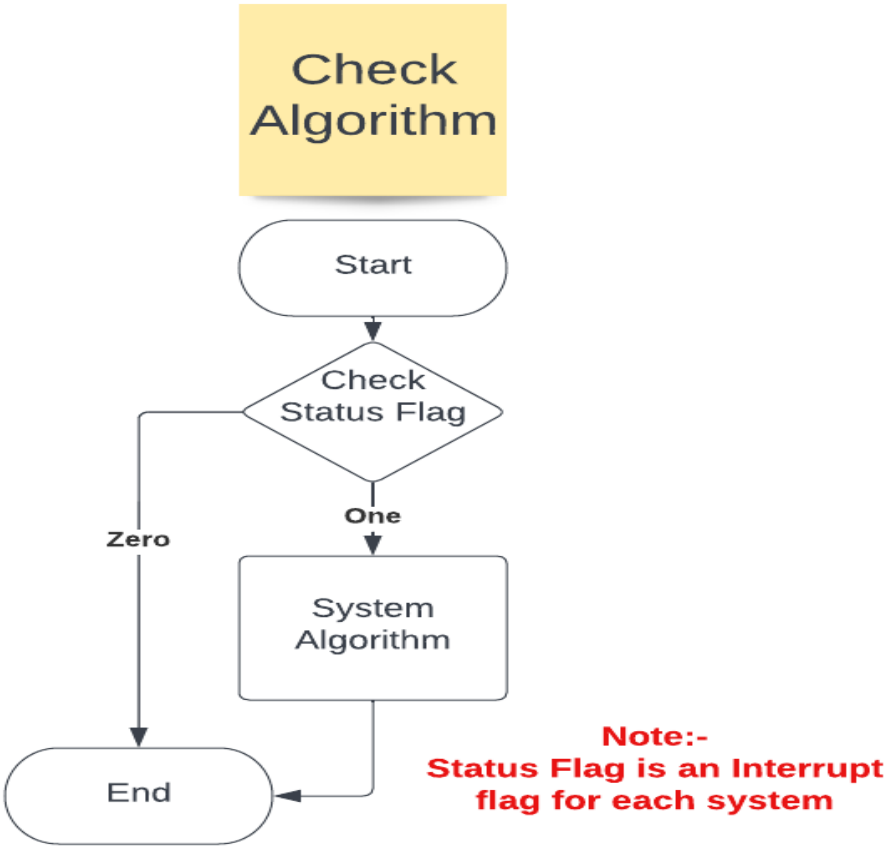
1)Main Block Diagram



2)Main Algorithm



Each System has the same algorithm for Checking.



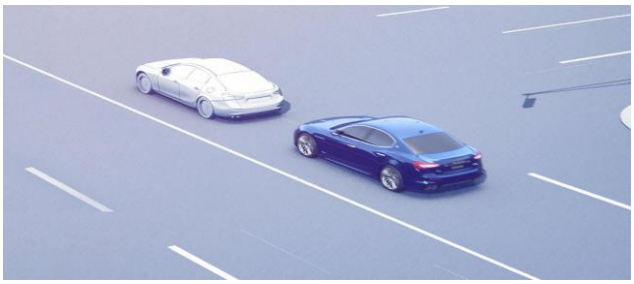
PROJECT SYSTEMS

Specifically handling 5 main Systems

1) Electronic Emergency Brake Lights (EEBL)
2) Blind Spot Warning (BSW)
3) Intersection Movement Assist (IMA)
4) Do Not Path Warning (DNPW)
5) Forward Collision Warning (FCW)

1➔Electronic Emergency Brake Lights (EEBL)

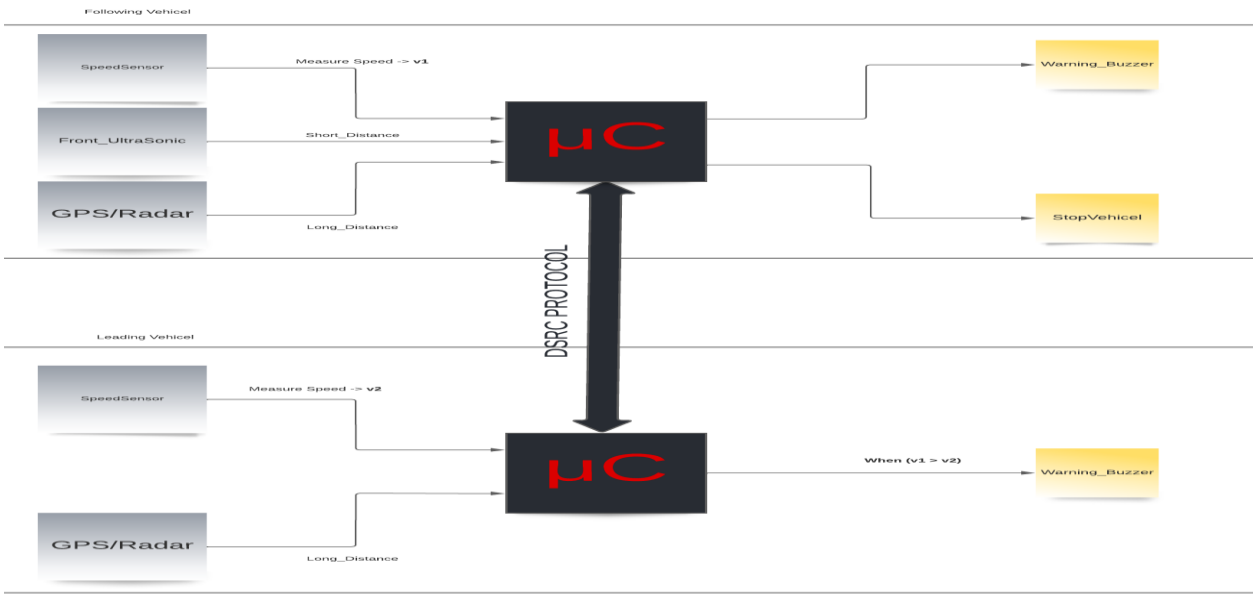
Every single day we always face the following situation , when there is a hard-braking vehicle in the pass ahead, or any object just came out of nowhere in front of another vehicle, the driver of this vehicle may not be able to get a proper chance to brake his car and avoid collisions that may occur, Here comes the use of our system “Emergency Electronic Brake”



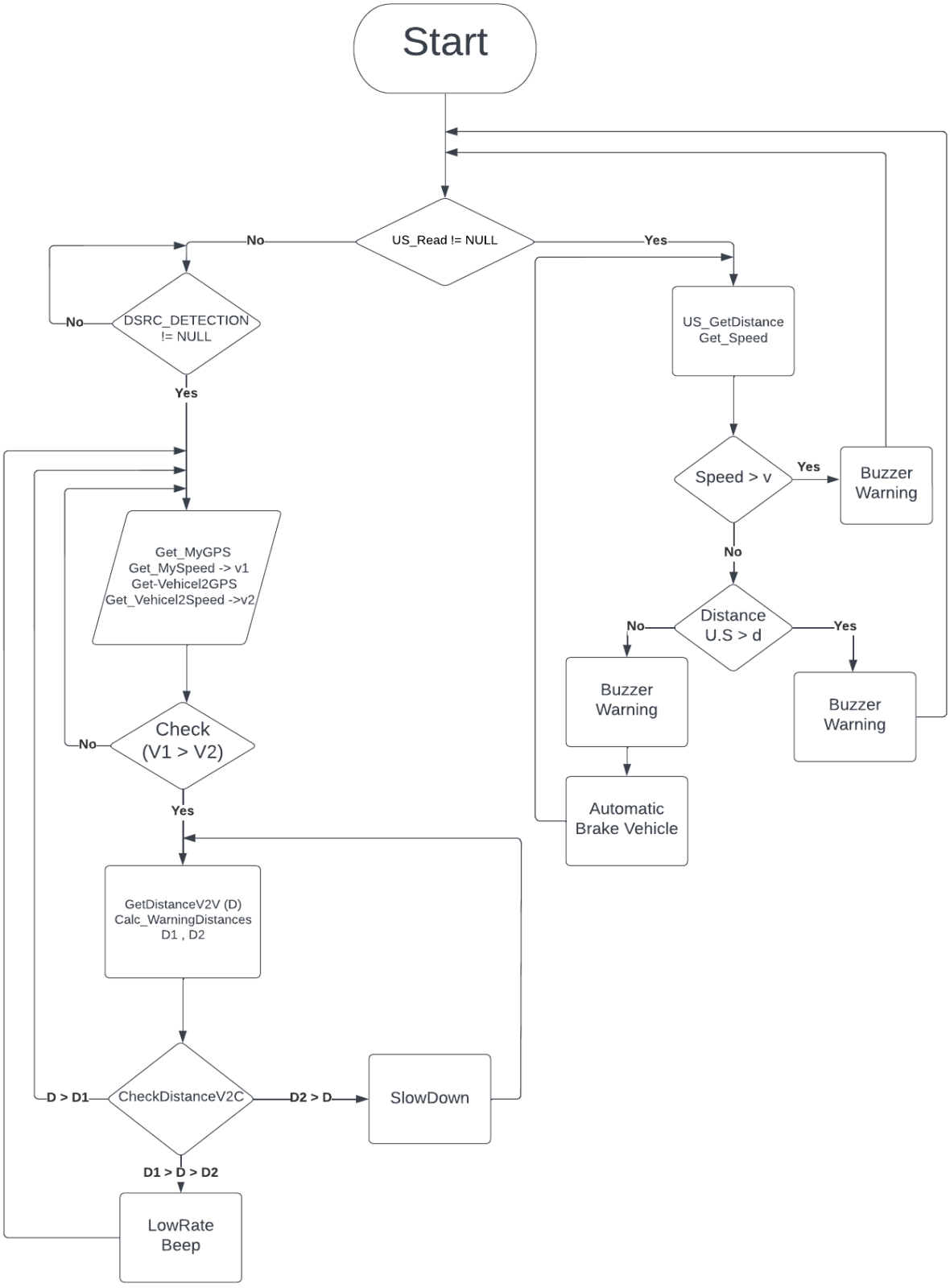
When such a situation occurs, The Rear vehicle will automatically send a warning through an actuator to the driver when the distance between the two vehicles a threshold distance, If the driver did not react properly to this waring and both cars still getting closer, then for a certain distance the ECU will automatically brake the care without any control from the driver side.

How does the system work ?

1)Block Diagram:

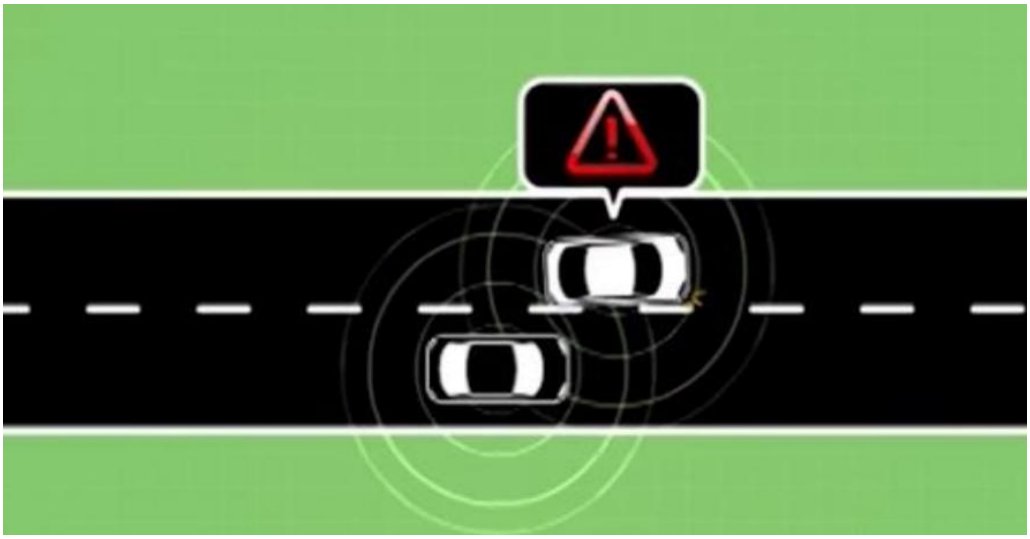


2)FlowChart:


Start
US_Read != NULL
No
Yes
DSRC_DETECTION != NULL
No
Yes
US_GetDistance Get_Speed
Speed > v
Yes
Buzzer Warning
No
Distance U.S > d
No
Yes
Buzzer Warning
Buzzer Warning
Automatic Brake Vehicle
Get_MyGPS
Get_MySpeed -> v1
Get-Vehicel2GPS
Get_Vehicel2Speed ->v2
Check (V1 > V2)
No
Yes
GetDistanceV2V (D)
Calc_WarningDistances
D1 , D2
CheckDistanceV2C
D > D1
D2 > D
SlowDown
D1 > D > D2
LowRate Beep

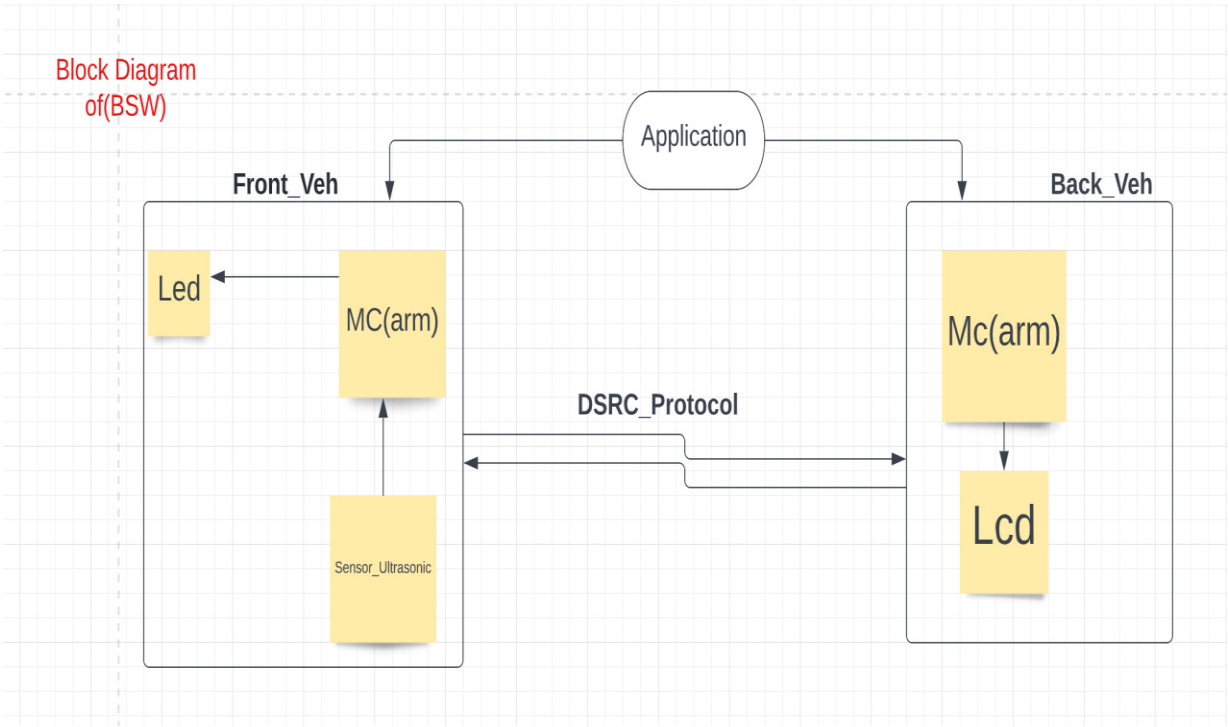
2➔Blind Spot Warning (BSW)

When there is a car that may not be visible to the car driver, because of v2v communication a warning message is issued to make you aware of the presence of this vehicle , should you attempt to lane change this warning message will tell you that it's not safe to lane change.

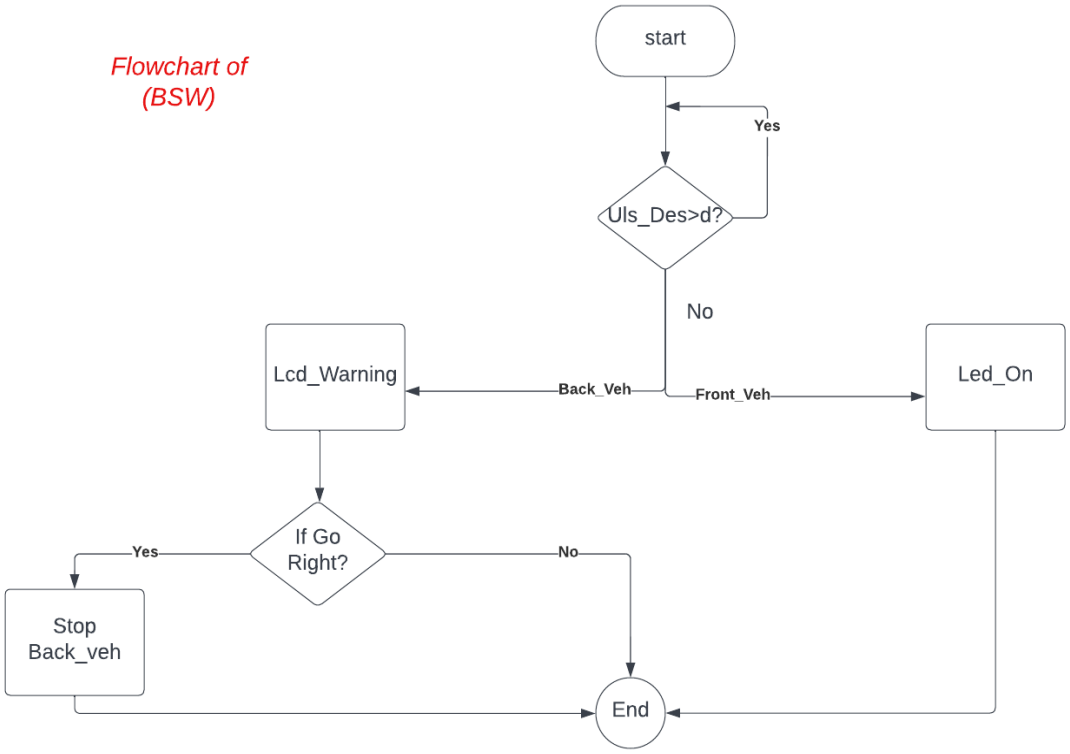


How does the system work ?

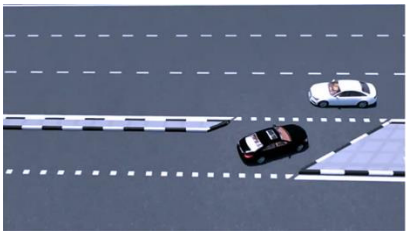
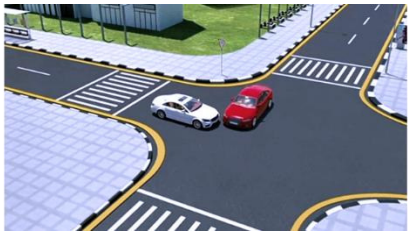
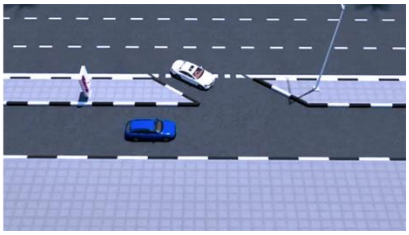
1)Block Diagram:



2)FlowChart



3➔Intersection Movement ASSIST(IMA)

The problem of intersection traffic is very dangerous on man life

Every year, the Federal Highway Administration (FHA) reports approximately 2.5 million intersection accidents. Most of these crashes involve left turns.

Nationally, 40 percent of all crashes involve intersections, the second largest category of accidents, led only by rear-end collisions. Fifty percent of serious collisions happen in intersections and some 20 percent of fatal collisions occur there.

An estimated 165,000 accidents occur annually in intersections caused by red-light runners. Fatalities caused by red-light runners run from 700-800 a year.

Making Intersections Safer

In the past few years, a quarter of all traffic deaths and about half of all injuries in the United States occur at intersections. That's why a big part of tackling road safety challenges involves intersections. Many strategies include geometric design and traffic control devices such as signals, signs, and markings. A combination of these different strategies is required to solve the issue.

Intersection safety is a top priority in the local, state and national levels. Many organizations such as the National Highway Transportation Safety Administration, Federal Highway Administration, Institute of Transportation Engineers and other public and private sectors continue to develop resources to make intersections safer.

we can solve the problem using V2V (vehicle to vehicle) communication technology using some modules including sensors , mcus and actuators

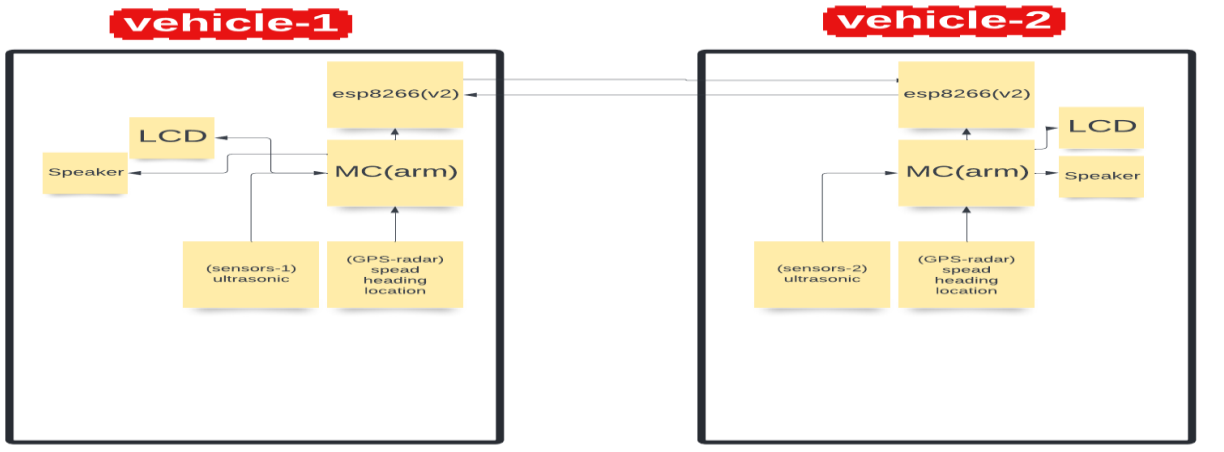
We will use radar, gps, ultrasonic, lcd, speaker, DSRC com_protocol

implementing some algorithms for different scenarios will solve the problem reducing or even preventing traffic intersection death cases keeping transportation better and safe for people precious life.

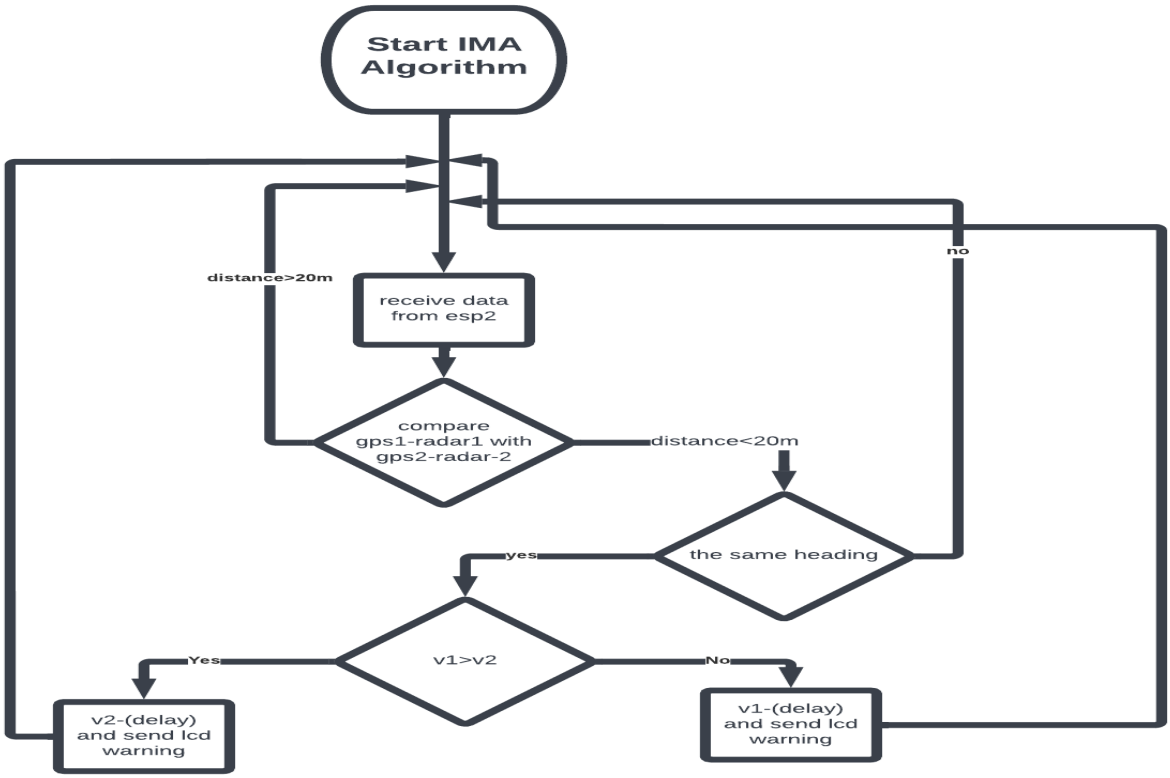
All this to determine the intersection points in the traffic lanes and alert the driver to take quick action before a disaster occurs.

How does the system work ?

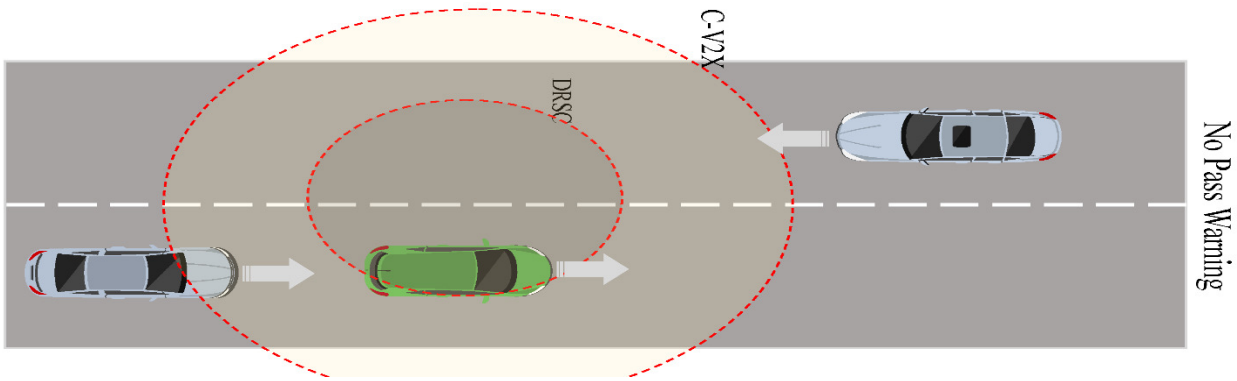
1)Block Diagram:



2)FlowChart:



4➔Do Not Pass Warning(DNPW)



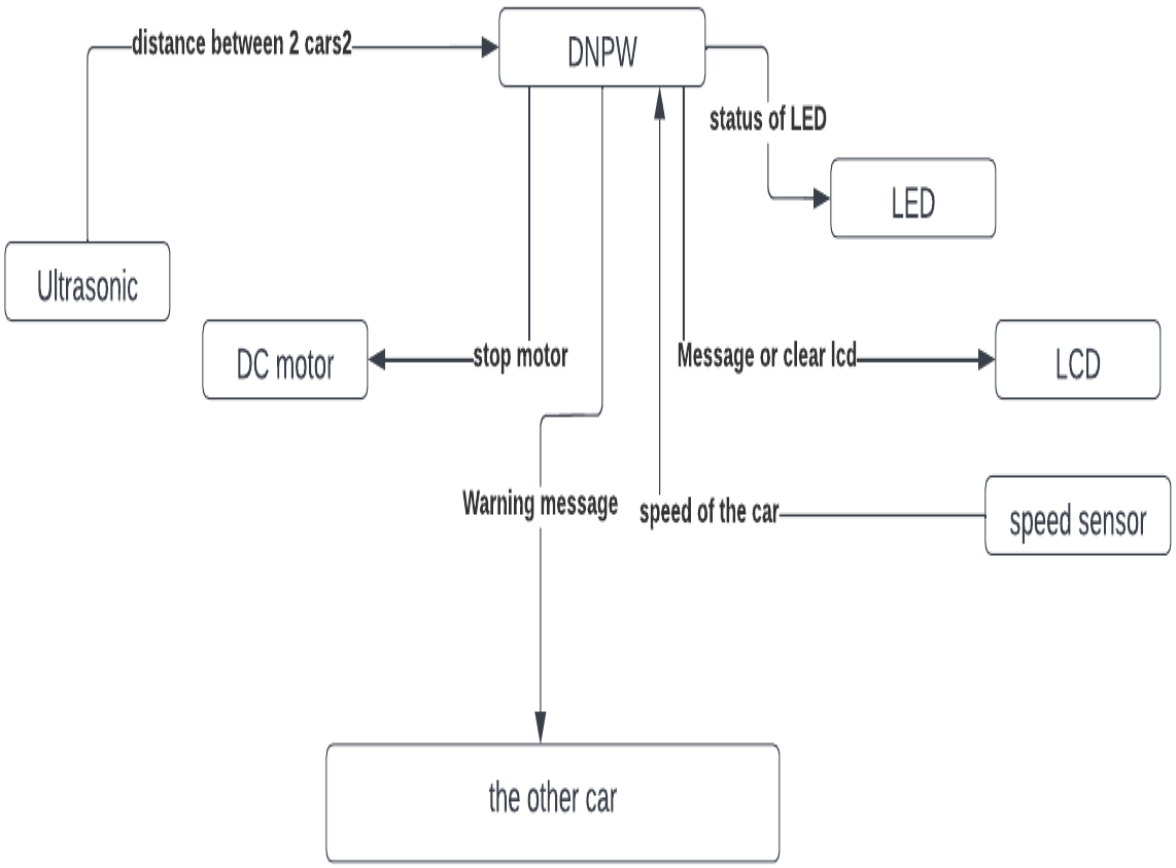
The Do Not Pass Warning (DNPW) application is intended to warn the driver of the vehicle during a passing maneuver attempt

when a slower moving vehicle, ahead and in the same lane, cannot be safely passed using a passing zone which is occupied by vehicles in the opposite direction of travel.

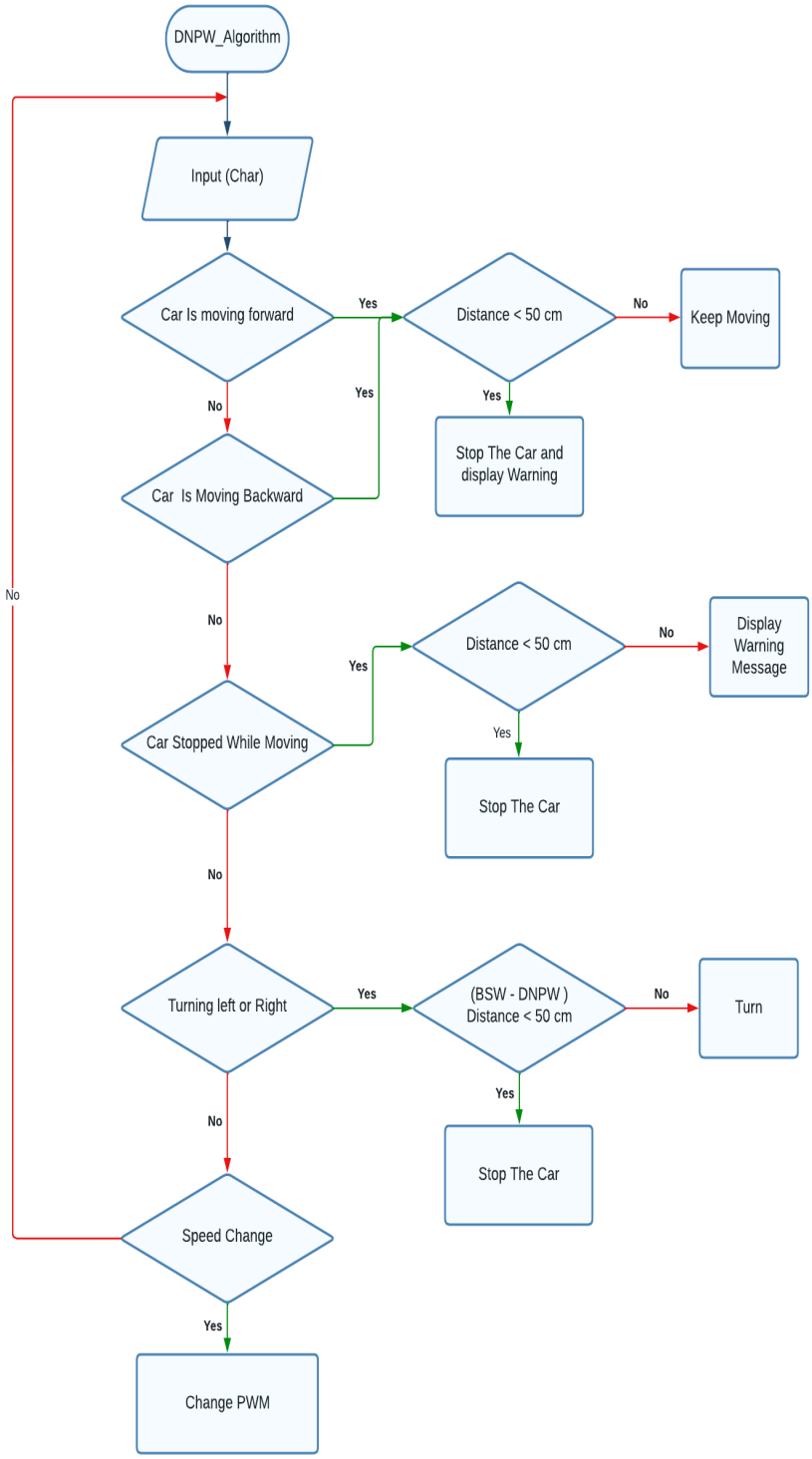
The system sends a warning message to the driver in order to prevent the crash. It may also stop the car if the distance was very small

How does the system work ?

1)Block Diagram:

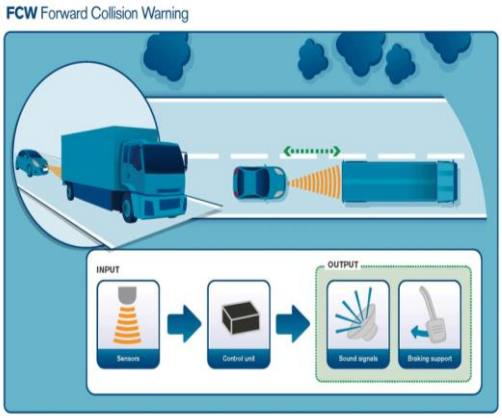


2)FlowChart:


DNPW_Algorithm
Input (Char)
Car Is moving forward
Yes
Distance < 50 cm
No
Keep Moving
Yes
Stop The Car and display Warning
No
Car Is Moving Backward
Yes
No
Distance < 50 cm
No
Display Warning Message
Yes
Car Stopped While Moving
Yes
Stop The Car
No
Turning left or Right
Yes
(BSW - DNPW) Distance < 50 cm
No
Turn
Yes
Stop The Car
No
Speed Change
No
Yes
Change PWM

5➔Forward Collision Warning (FCW)

Rear-end crashes are one of the most common types of collisions. They are often the result of drivers following too closely or drivers that are distracted or speeding.
In fact, 40% of rear-end collisions have no brake application whatsoever, reflecting driver distraction. The NTSB has found that over 80% of rear-end crashes could be prevented with forward collision avoidance systems. The driver whose car hit the car ahead is typically considered to have been at-fault.



What is Forward Collision Warning?

Forward collision warning is a driver safety system that uses radar, lasers, or cameras to detect other vehicles in the front area of the driver's car. Some safety systems can also detect other objects, like people, cyclists, and animals in the path of a moving vehicle.

How Does Honda Forward Collision Warning Work ?

Now that we can answer the question , " What is FCW in a car ? " you might begin to wonder , " How does Honda Forward Collision Warning work exactly ? " The Forward Collision Warning system operates at speeds at or above 3 mph and uses sensors to detect the vehicles directly in front of you , to alert drivers of possible collisions to avoid on Taunton roads * . Below is the play - by - play of how the CW Honda system operates :

1. The FCW detects that the distance between your vehicle and the vehicle in front of you is diminishing

2. The system compares the two vehicles ' speeds to calculate the risk of an impending collision .

3. To alert the driver , the FCW emits a beeping sound and flashes a " Brake " message on the Multi - Information Display

4. The driver can then brake to either avoid or reduce the impact of the collision .

5. If your vehicle also has the Collision Mitigation Braking System TM (CMBSTM) , your vehicle with automatically begin to apply the brakes if you do not react in time .

. Honda Forward Collision Warning features include

The FCW scanners read up to 500 feet ahead at a rate of over 20 times per second

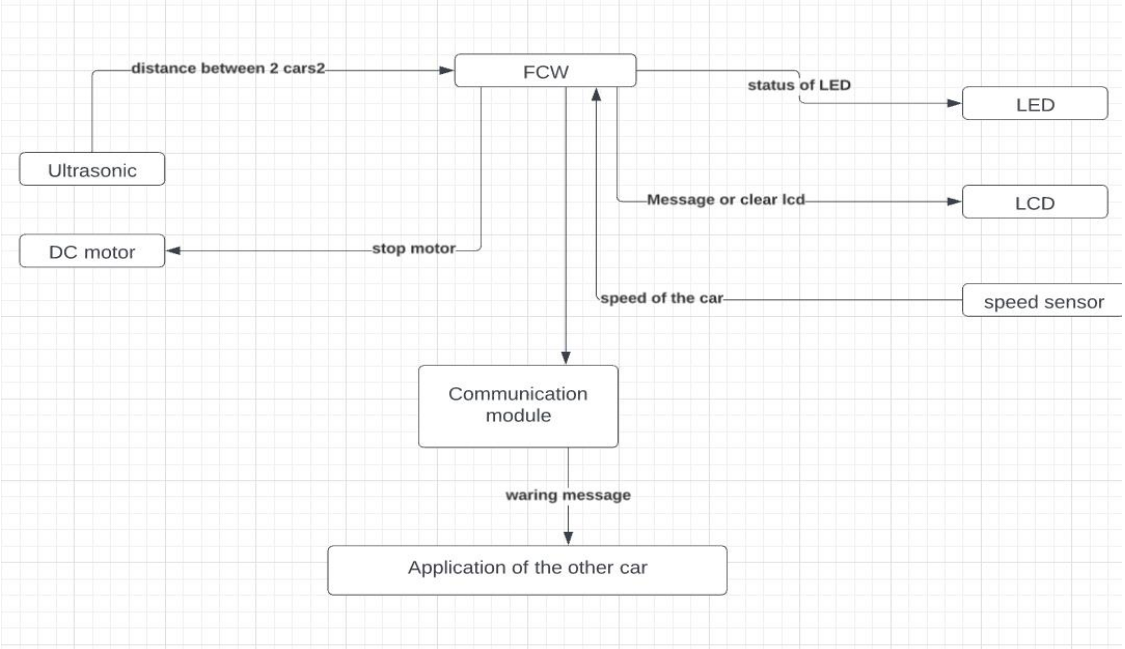
The system detects vehicles , bicycles , and motorbikes

• Strong performance in all weather conditions and at night

• Offers up to 5 seconds of warning time for drivers to react

How does the system work ?

1)Block Diagram:



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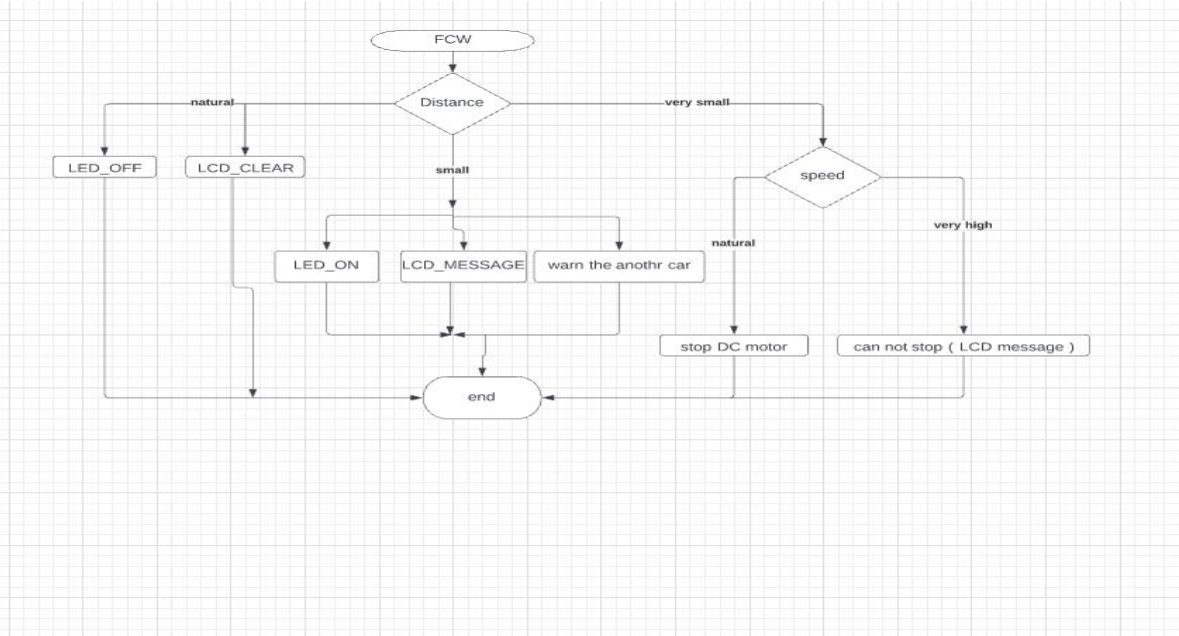


SOFTWARE ARCHITECTURE

AUTOSAR SOFTWARE ARCHITECTURE

AUTOSAR or Automotive Open System Architecture was developed to create a common standardized software architecture for designing automotive electronic control units (ECUs). The AUTOSAR architecture is based on a 3-layered architecture model.

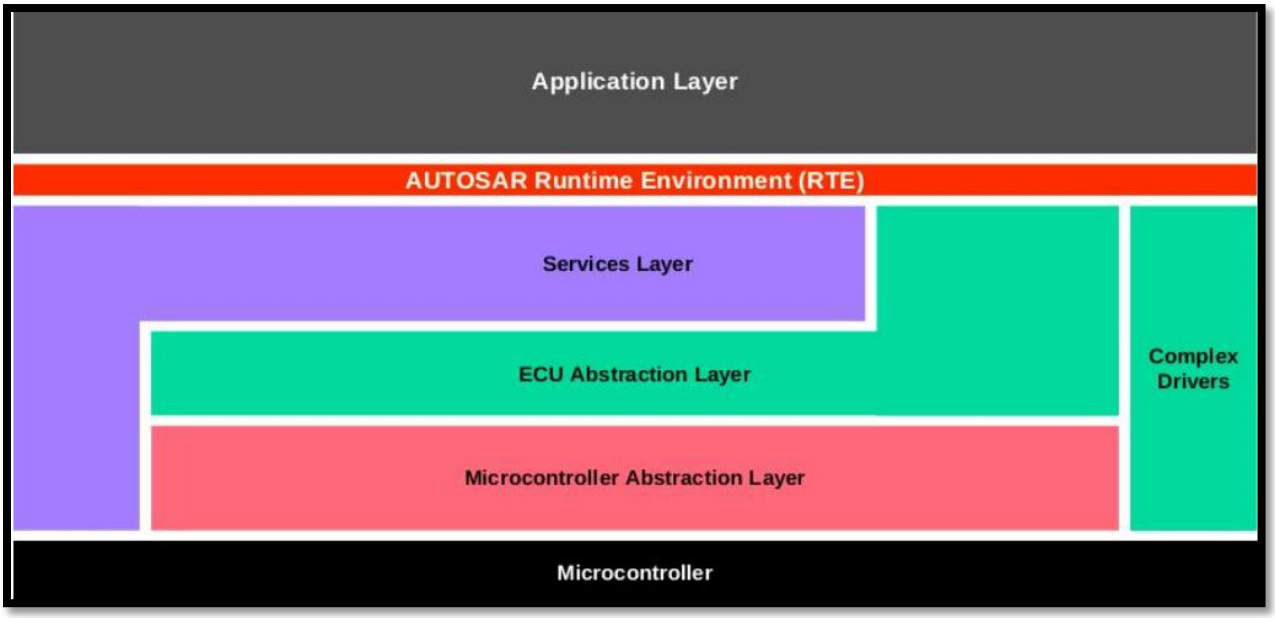
The 3-Layered AUTOSAR Architecture

The AUTOSAR specifies a three-layer architecture, which are categorized into following modules:

1) Basic software (BSW): can be defined as standardized software module offering various services necessary to run the functional part of the upper software layer. This layer consists of the ECU specific modules along with the generic AUTOSAR modules.
It is divided into three sub layers namely the Services layer, ECU (Electronic Control Unit) abstraction layer, and the Microcontroller Abstraction Layer (MCAL).
The MCAL is a software module that abstracts all the upper layers (the application layer and the BSW) Microcontroller. Thus, MCAL helps in making the upper layers independent of the low-lying hardware platform.

2) Runtime environment (RTE): acts as a middleware between the AUTOSAR application layer and the lower layers. Basically, the RTE layer manages the inter- and intra-ECU communication between application layer components as well as between the BSW and the application layer.

3) Application layer: The AUTOSAR application layer includes various application specific software components that are designed to execute specific set of tasks, as per the use-case.



Contribution

We Mapped this architecture model to our project in order to achieve the following goals:

1) Modular design

Being able to divide the project into small software modules easy to implement, test and develop.

2) Standardization of Basic software

Having the Application layer independent of basic software layers as to reduce the time and money to be spend on BSW development. AUTOSAR defines the HDL (High level design) and structure of BSW so that only LLD (Low level design) Needs to be taken care by the company to have a standard BSW and concentrate its major focus on development of application software and earn good profit.

3) Software Component Re-Usability:

Being able to use most of software components on different microcontroller structures. Previously, the software components were written and were dependent on underlying hardware and hence each software specific to its ECU. But AUTOSAR has made software components independent.

REFERENCES

1-AUTOSAR Layered Architecture → https://www.embitel.com/tag/autosar-layered-architecture

2-V2V References

- **Sources for Intersection Safety**

-The National Highway Traffic Safety Administration is the primary source of traffic accident statistics.

-The Fatality Analysis Reporting System is an encyclopedia that allows easy retrieval of fatality statistics.

- **Research Reports**

https://www.rxmechanic.com/collision-avoidance-system-cars/

https://www.marketwatch.com/press-release/automotive-collision-avoidance-system-market-research-report-future-market-insights-porter-five-forces-analysis-research-forecast-2022-to-2028-2022-08-12